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10/733,261	12/12/2003	Yoo Jin Lee	46136	8663

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EXAMINER	
BARTON, JEFFREY THOMAS	

ART UNIT	PAPER NUMBER
1753	

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07/17/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/733,261	LEE ET AL.	
	Examiner	Art Unit	
	Jeffrey T. Barton	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) *12-14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20031212*.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *20070711*.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-11, drawn to a solar cell, classified in class 136, subclass 261.

II. Claims 12-14, drawn to a method of making a solar cell, classified in class 438, subclass 57.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make another and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product can be made by a process that does not involve photolithography, such as screen printing.

3. Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions have acquired a separate status in the art in view of their different classification, restriction for examination purposes as indicated is proper.

4. Because these inventions are independent or distinct for the reasons given above and there would be a serious burden on the examiner if restriction is not required because the inventions require a different field of search (see MPEP § 808.02), restriction for examination purposes as indicated is proper.

5. During a telephone conversation with Ron Grubb on 9 July 2007 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-11. Affirmation of this election must be made by applicant in replying to this Office action. Claims 12-14 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1, 2, and 8-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Guha et al. (US 4,555,586) Supporting information is provided by Barnes et al (US 4,599,586) and the "All-Polyimide Heaters" website.

Regarding claim 1, Guha et al disclose a solar cell device (Figures 1 and 6; Column 17, lines 44-49) comprising sequentially stacked layers of a first electrode (e.g. 22) p-type semiconductor (e.g. 20a; note Column 10, lines 60-64), an intrinsic absorber (e.g. 18a), an n-type semiconductor (e.g. 16a; note Column 10, lines 60-64) and second

electrode on a substrate (11; Column 10, lines 20-26; electrode can be a coating on an insulating substrate); and a Minco Products Thermofoil heater positioned on the rear surface of the cell. (Column 17, lines 44-54)

As shown by Barnes et al in Figure 1 and at Column 2, lines 9-17, and on the "All-Polyimide Heaters" website, Thermofoil heaters are thin film labyrinth heaters that are embedded between polyimide films on either side of the heater element. Barnes et al disclose that the overall thickness of the heater is approximately 6.5 mil (i.e. about 165 micrometers). Accordingly, all layers of the heater are considered to be thin films.

Therefore, the attachment of the Thermofoil heater to the back side of the cell in Guha et al meets the limitation to "an insulating film formed on the second electrode" since the inner polyimide layer is "on the second electrode" in that it overlies the second electrode via the substrate. In addition, the thin film labyrinth heater element of the Thermofoil heater meets the limitation to "a thin film heater pattern formed on the insulating film". In this rejection, the term "formed" is read as meaning "shaped to fit". The process of attaching a film heater to a substrate clearly reads on such forming, in that the shape of the heater conforms to that of the substrate.

Regarding claim 2, as shown in the illustration of a Thermofoil heater shown by Barnes et al, a Thermofoil heater includes an outer polyimide film that reads on the claimed protection film.

Regarding claim 8, Guha et al disclose a glass substrate. (Column 10, lines 23-26)

Regarding claims 9 and 10; Guha et al disclose a plastic substrate (Column 10, lines 23-26), metal electrode associated with substrate 11 (Column 10, lines 20-33), and transparent conductive electrode 22. (Column 10, lines 50-55) The wording of the "sequentially stacking" limitation of claim 1 can be interpreted such that either the first electrode or the second electrode can be nearest the substrate. This breadth of the limitation, in conjunction with the teaching of Guha et al that either an n-i-p or p-i-n sequence is contemplated (Column 10, lines 60-64) causes the disclosure of Guha to meet the limitations of both claims 9 and 10.

Regarding claim 11, Guha et al disclose a metallic substrate 11. (Column 10, lines 20-23) the insulating film, thin film heater, and protection film associated with the Thermofoil heater (Discussed above in addressing claims 1 and 2) are "on the electrode" via the intervening layers.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

11. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claims 1-5, 8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shah et al (Proc. 17th EU PVSEC reference) in view of Guha et al. Supporting evidence is provided by Barnes et al (US 4,599,586) and the "All-Polyimide Heaters" website.

Shah et al disclose a solar cell device (Figure 5) constructed by sequential deposition of a first electrode (ZnO layer), p-, i-, and n-type semiconductor layers (a-Si:H cell comprises these layers), and a second electrode (back contact) on a substrate (glass). Shah et al discuss problems inherent in these cells due to the Staebler-Wronski effect. (Introduction, 4th paragraph ; Section 4, 2nd paragraph)

Shah et al do not explicitly disclose the order in which the p-, i-, and n-type a-Si:H layers are deposited on the first electrode, nor do they disclose the claimed insulating film or thin film heater pattern.

Guha et al disclose similar tandem cell structures, teaching that either sequence of the layers (i.e. p-i-n vs. n-i-p) gives a working cell. (Column 10, lines 60-64) Guha et al also teach that attaching an electric heater, such as a Thermofoil heater from Minco Products, Inc., on the rear surface of such a tandem cell provides a means for annealing the cell in order to alleviate the Staebler-Wronski effect and restore the higher original cell efficiency. (Column 17, line 44 - Column 18, line 20; Column 1, lines 17-29)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shah et al by specifically sequentially depositing p-type, i-type, and n-type layers to form the a-Si:H cell, as taught by Guha et al, because either p-i-n or n-i-p configuration provides a functioning cell, and either configuration is conventionally used. Selection of either option is within the level of ordinary skill in the art.

It would also have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shah et al by attaching a Thermofoil heater at the rear surface of the cell (i.e. adjacent the back contact in Figure 5), as taught by Guha et al, because Guha et al teach that such a heater provides a means for reducing the loss of efficiency due to the Staebler-Wronski effect, which is a problem acknowledged by Shah et al. Use of such a heater would be expected to increase the

efficiency of the cell after the initial photodegradation that universally occurs in a-Si:H cells.

As shown by Barnes et al in Figure 1 and at Column 2, lines 9-17, and on the "All-Polyimide Heaters" website, Thermofoil heaters are thin film labyrinth heaters that are embedded between polyimide films on either side of the heater element. Barnes et al disclose that the overall thickness of the heater is approximately 6.5 mil (i.e. about 165 micrometers). Accordingly, all layers of the heater are considered to be thin films.

Therefore, the attachment of the Thermofoil heater to the back side of the cell of Shah et al meets the limitation to "an insulating film formed on the second electrode" since the inner polyimide layer would be attached to the second electrode. In addition, the thin film labyrinth heater element of the Thermofoil heater meets the limitation to "a thin film heater pattern formed on the insulating film". In this rejection, the term "formed" is read as meaning "shaped to fit". The process of attaching a film heater to a surface clearly reads on such forming, in that the shape of the heater conforms to that of the surface.

Regarding claim 2, as shown in the illustration of a Thermofoil heater shown by Barnes et al, a Thermofoil heater includes an outer polyimide film that reads on the claimed protection film.

Regarding claim 3, a p-i-n or n-i-p a-Si:H cell will include three amorphous layers as claimed.

Regarding claim 4, Shah et al disclose another stacked structure between the n-type amorphous semiconductor layer and the second electrode, comprising p-, i-, and n-

type microcrystalline silicon layers. (Figure 5; μc-Si:H cell) The order must obviously match that of the a-Si:H cell, in order to connect the cells in series between the electrodes.

Regarding claim 5, the amorphous layers of Shah et al are thinner than the corresponding microcrystalline layers. (Figure 5; Section 4) In addition, In *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), *cert. denied*, 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit held that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. In this case, although there is a difference in operation dependent upon the relative thickness of the i-type absorber layers, which Shah et al clearly discloses as having the claimed relative thicknesses, there no such clear dependence of operation of the relative thicknesses of the n- and p-type layers.

Regarding claims 8 and 10, Shah et al disclose a glass substrate, and a first electrode made of a TCO. (Figure 5) The back contact is obviously advantageously formed from a metal, since light is not required to pass through this layer and metals have higher conductivity than other conventional solar cell electrode materials, such as transparent conducting oxides.

Regarding claim 11, the back contact, which could obviously be made of metal since it functions as an electrical contact, reads on the instant metallic substrate. The insulating film, thin film heater, and protection film associated with the Thermofoil heater

(Discussed above in addressing claims 1 and 2) are "on the electrode" via the intervening layers.

13. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Guha et al in view of the "Heater/Sensor/Flex-Circuits Integrate Thermal Functions" website. Supporting information is provided by Barnes et al (US 4,599,586) and the "All-Polyimide Heaters" website.

Guha et al with supporting information from Barnes et al and the "All-Polyimide Heaters" website is relied upon for the reasons given above in addressing claims 1, 2, and 8-11. Guha et al also teach a control system for controlling the heater. (Column 17, lines 61-66)

None among Guha et al, Barnes et al, and the "All-Polyimide Heaters" website explicitly teach a device for measuring a temperature as claimed.

The "Heater/Sensor/Flex-Circuits Integrate Thermal Functions" website teaches that a typical thermal control system includes a temperature sensor (1st paragraph) and advertises a Thermofoil heater (3rd paragraph) which includes such a sensor, such as a thermocouple. (4th paragraph) The website teaches the advantage of this design in reduced assembly time and improved temperature control. (1st paragraph)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the system of Guha et al by incorporating a thermocouple temperature sensor into the heating foil, as taught by the "Heater/Sensor/Flex-Circuits Integrate Thermal Functions" website, because the "Heater/Sensor/Flex-Circuits

Integrate Thermal Functions" website teaches the advantages of this arrangement in improved temperature control and reduced device assembly time. In addition, the sensor would obviously be placed within the perimeter of the heater, in order to provide an accurate temperature reading. Any position within the perimeter of the heater will meet the limitation to the device being "between relevant portions of the thin film heater pattern", as all portions of the pattern are relevant to the heating function. Inclusion of such a temperature sensor would also have been obvious due to the teaching of a controller by Guha et al, since such controllers typically require a temperature sensing element as a basis for temperature control.

14. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shah et al and Guha et al as applied to claims 1-5, 8, 10, and 11 above, and further in view of the "Heater/Sensor/Flex-Circuits Integrate Thermal Functions" website. Supporting information is provided by Barnes et al (US 4,599,586) and the "All-Polyimide Heaters" website.

Shah et al and Guha et al with supporting information from Barnes et al and the "All-Polyimide Heaters" website are relied upon for the reasons given in addressing claims 1-5, 8, 10, and 11 above.

None of these references explicitly discloses a device for measuring a temperature as claimed.

The "Heater/Sensor/Flex-Circuits Integrate Thermal Functions" website teaches that a typical thermal control system includes a temperature sensor (1st paragraph) and

advertises a Thermofoil heater (3rd paragraph) which includes such a sensor, such as a thermocouple. (4th paragraph) The website teaches the advantage of this design in reduced assembly time and improved temperature control. (1st paragraph)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the system of Shah et al by replacing the Thermofoil heater of Guha et al with a Thermofoil heater having an incorporated thermocouple temperature sensor, as taught by the "Heater/Sensor/Flex-Circuits Integrate Thermal Functions" website, because the "Heater/Sensor/Flex-Circuits Integrate Thermal Functions" website teaches the advantages of this arrangement in improved temperature control and reduced device assembly time. In addition, the sensor would obviously be placed within the perimeter of the heater, in order to provide an accurate temperature reading. Any position within the perimeter of the heater will meet the limitation to the device being "between relevant portions of the thin film heater pattern", as all portions of the pattern are relevant to the heating function. Inclusion of such a temperature sensor would also have been obvious due to the teaching of a controller by Guha et al, since such controllers typically require a temperature sensing element as a basis for temperature control.

15. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shah et al and Guha et al as applied to claims 1-5, 8, 10, and 11 above, and further in view of Dickson et al. (US 4,892,592) Supporting information is provided by Barnes et al and the "All-Polyimide Heaters" website.

Shah et al and Guha et al with supporting information from Barnes et al and the "All-Polyimide Heaters" website are relied upon for the reasons given in addressing claims 1-5, 8, 10, and 11 above.

Shah et al do not explicitly disclose a substrate made of plastic or silicon.

Dickson et al is relied upon for teaching what is well known, that it is conventional in the art to use glass or plastic substrates having transparent conductive layers for the front electrode in thin film solar cells. (Column 1, lines 20-33)

It would have been obvious to one having ordinary skill in the art to further modify the device of Shah et al by replacing the glass substrate with a plastic substrate, as taught by Dickson et al, because the teaching of Dickson et al indicates that these are known equivalent structures for providing a transparent front electrode for thin film solar cells. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

The wording of the "sequentially stacking" limitation of claim 1 can be interpreted such that either the first electrode or the second electrode can be nearest the substrate. This breadth of the limitation, in conjunction with the teaching of Guha et al that either an n-i-p or p-i-n sequence is contemplated (Column 10, lines 60-64) causes the disclosure of the prior art to meet the limitations of the claim. As noted above, Shah et al teach a front electrode made of a TCO. (Figure 5) The back contact is obviously advantageously formed from a metal, since light is not required to pass through this

layer and metals have higher conductivity than other conventional solar cell electrode materials, such as transparent conducting oxides.

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey T. Barton whose telephone number is (571) 272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JTB
11 July 2007

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